Operator Certification Program Standards

Association of Boards of Certification

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Foreword

The Association of Boards of Certification (ABC) is an association through which certifying authorities may communicate in order to better discharge their responsibility to ensure the competence of environmental occupations and laboratories. ABC has been assisting states and provinces with environmental certification programs since 1972. Membership consists of over 90 certifying authorities representing more than 40 states and 10 Canadian provinces which certify over 150,000 water and wastewater operators, laboratory analysts, and backflow prevention assembly testers. Member services include a testing service, reciprocity assistance, publications and networking.

The purposes of ABC as listed in the *Bylaws* are "to improve certification laws, their administration and effectiveness; to promote certification as a means of ensuring effective operation; to define and maintain internationally recognized qualifications for certification in established categories; to promote uniformity of standards and practices in certification; to facilitate the transfer of certification between certifying authorities; and to assist newly created certifying authorities as they set up their initial policies and procedures." One mechanism for accomplishing these purposes is the use of the ABC Standards. ABC has maintained these standards in various formats since 1972. A more detailed history follows on the next page.

The standards are intended as a model program for certification authorities. They are useful both to new programs and to existing programs that are updating their regulations or procedures. These standards are also used by ABC as the baseline for its reciprocity program. Members are not required to meet these standards as ABC recognizes the need for each certification authority to respond to local conditions.

The standards are developed and revised by the Standards Committee, one of the many volunteer committees of ABC. All standards and revisions are approved by the governing bodies and ratified by the members. The standards are considered dynamic documents as they are revised periodically to reflect changes in technology and certification issues.

The following are the standards and related documents published by ABC which are available to assist certification authorities:

- Operator Certification Program Standards
- Environmental Laboratory Analyst Certification Program Standards
- Backflow Prevention Assembly Tester Certification Program Standards
- Biosolids Land Appliers Certification Program Standards
- Model Act and Regulations
- Certification Program Guide

Historical Perspective

The Standards Council was established by ABC's Board of Directors at their January 1991 meeting as a result of recommendations from the Legislative Liaison Committee. The Standards Council was charged with updating the association's current standards and developing new standards when appropriate. The membership discussed the importance of the standards at the 1991 annual conference in Sacramento, CA and approved preparing a standards publication.

The standards were developed from the Model Certification Act, Model Certification Regulations, and the Certification Program Guide. The model act and regulations came out of model guidance that was developed by a joint committee of the American Water Works Association, the Conference of State Sanitary Engineers, and the Water Environment Federation. The joint committee first developed guidance for establishing a voluntary certification program for water and wastewater treatment plant operators and in 1966 they completed development of the model mandatory certification act and regulations. The 1966 model act was revised and presented to the Council of State Governments (COSG) Committee on Suggested State Legislation at its meeting in Washington in May 1972. The resulting COSG model act with sample regulations was approved and published in 1973. ABC has updated the model act and regulations through US Environmental Protection Agency project grants and recommendations of ABC's technical committees.

The Standards Council presented the standards at the 1992 annual conference in Orlando, Florida. Based on comments received at the conference, the standards were revised and presented to the Board of Directors at their June 1992 meeting for review and were approved by the board in September 1992. The standards were ratified by regular members on December 11, 1992.

In 1993, the Standards Council recommended revising the standards to specify that the education, experience, and evaluation requirements for certification are corequisites, to expand the In-Training category to all classes of operators, to create an In-Training category for all classes of laboratory analysts, and to require that examinations be taken in order from Class I to IV. These revisions were approved by the Executive Committee (August 1993) and the Board of Directors (October 1993) and ratified on January 22, 1994.

In 1995, the Standards Council was charged with dividing the Certification Program Standards into separate documents for operators, laboratory analysts, and backflow prevention assembly testers and updating the water and wastewater treatment plant point rating systems. Laboratory ratings were removed from the water treatment plant point rating system because laboratory capabilities are taken into account in other treatment processes. Also, definitions were added to both rating systems.

The Board of Directors approved the separate standards documents at their December 1995 meeting, and on January 19, 1996 the regular members ratified the standards. The revised plant point rating systems for water and wastewater treatment were approved by the board at their January 1996 meeting and ratified by the regular members on March 15, 1996. The industrial waste treatment plant point rating system was revised during 1996 and approved by the board at their October 1996 meeting.

ABC recommends that certification boards phase in the new plant point rating systems gradually. Also, certification boards have the option of modifying the systems in accordance with the needs created by particular complexities of any specific environmental control utility because of special features, design characteristics which make operation more difficult than normal, or a combination of these factors as stated in the Model Act and Regulations.

In 1998, the Standards Committee was charged with reviewing the standards regarding Very Small Water Systems. During the course of the year, this was accomplished by the Standards Committee and approved by both the ABC Executive Committee and Board of Directors, then ratified by regular members on April 2, 1999. The additional language for Very Small Water Systems was added during 1999.

In 2001, ABC's Standards Committee was charged with reviewing substitutions for grade school and high school in all the standards (in the *Operator Certification Program Standards*, this affects Appendix 7). This was accomplished by the Standards Committee and approved by the ABC Board of Directors, and the revised *Standards* were ratified by ABC regular members on September 28, 2002.

In 2002, the Board of Directors asked ABC Staff to develop a Closed Book Exam Policy for ABC's *Policies and Procedures* and all related Standards, which the Board then sent to the Standards Committee for review. The revisions recommended by the Standards Committee were approved by the ABC Board of Directors in January 2003,

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and the revised Standards were ratified by ABC regular members on June 14, 2003. (In the *Operator Certification Program Standards*, this affects Standard III.F.)

In 2003, the ABC Standards Committee was charged with reviewing the certification renewal requirements from the ABC *Operator Certification Program Standards.* The committee recommended eliminating the requirement for operators to have worked 20% of the time in their area of certification in order to renew their certificate. The revisions recommended by the Standards Committee were approved by the ABC Board of Directors in January 2005, and the revised Standards were ratified by ABC regular members on June 11, 2005. This affects Standard III.P and IV.C.

In September 2003, the ABC Certification Committee met and developed a revised definition of "Direct Responsible Charge" (DRC) to replace the existing definition contained in the *Operator Certification Program Standards.* The ABC Board of Directors assigned the ABC Standards Committee to review the definitions of DRC. A subcommittee of the Standards Committee reviewed and recommended the revised definition to the Standards Committee. The Standards Committee forwarded their recommended revisions to the Board of Directors which approved the definition with further revisions at its June 2006 meeting, and the new definition was ratified by ABC regular members on January 20, 2007. This definition affects Appendix 4, Appendix 5, and Appendix 7.

In June 2002 the Board of Directors approved a motion to refer the Water Treatment Plant Point Rating System to the Standards Committee for review and updating as needed. A subcommittee was formed. A recommended revised rating system was forwarded to the Board of Directors and approved at its October 2006 meeting, and ratified by ABC regular members on January 20, 2007. The Water Treatment Plant Point Rating System is Appendix 3 of the *Operator Certification Program Standards*.

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Standard I. Authorization

I.A The certification program shall be officially authorized to certify operators through legislation and/or regulations.

I.B The authorization should establish the certification requirements, define important terminology, establish the classification system for utilities, establish the qualifications for operator certification, establish the certification board, establish procedures for adopting regulations and administrative procedures, define prohibited acts and penalties, establish reciprocity, define funding authority, and incorporate severability.

I.C The certification program shall be governed by a single appointed certification board. If the program is in a single agency or is split between agencies such as the health department and/or the environmental agency, the single board serves in an official advisory capacity to all agencies. The certification board's stature should be such that its recommendations will be respected by all agencies concerned.

I.D Representatives to the certification board shall include:

- A representative from each state/provincial agency responsible for environmental control;
- A representative of a local government in a managerial position (not an elected official) responsible for environmental control;
- A management representative of an industry required to employ certified operators;
- A representative from a college, university, community college or vocational training school, who conducts environmental control education; and
- Certified operators holding active, valid certificates with representation from environmental control utilities.

Certification board representatives shall include at least one representative from a Very Small Water System. (Note: Very Small Water System requirement would not apply to a wastewater treatment certification board).

I.E Members of the certification board should serve three-year terms which are staggered so that the terms of one third of the members of the certification board shall expire each year. Members of the certification board may be reappointed but should not succeed themselves automatically and should not serve more than three consecutive terms.

I.F Each year the certification board should select, from its membership, a chair and such other officers as may be needed to conduct its business.

I.G All members of the certification board should be reimbursed for their actual and necessary expenses incurred while discharging their official duties.

I.H The certification board shall be responsible for the adoption of regulations, procedures, policies, and for the general direction of the program.

Standard II. Classification of Environmental Control Utilities

II.A All environmental control utilities actually used or intended for use by the public, or which discharge into receiving bodies of water, into the air, or on land shall be classified as Very Small Water System, Class I, Class II, Class III, or Class IV, with Class IV being the largest and most complex. (Note: Very Small Water System would not apply to a wastewater treatment plant).

II.B The classification shall take due regard to the size and type of the environmental control utility, the character of the substance treated, and other physical conditions affecting such environmental control utilities, and according to the skill, knowledge, and experience required of the certified operators.

II.C Water treatment plants, wastewater treatment plants, and industrial waste treatment plants shall be classified according to the points classification system listed in Appendix 1. Appendix 3 lists the point rating system for water treatment plants, Appendix 4 for wastewater treatment plants, and Appendix 5 for industrial waste treatment plants.

II.D Distribution systems and collection systems shall be classified by population. Appendix 6 lists the classification system for distribution systems and collection systems.

II.E Sections II.C and II.D are not applicable to public water systems which meet the definition of Very Small Water System in Appendix 2.

Standard III. Qualifications for Certification

III.A Certification shall be issued to each qualified person upon recommendation of the certification board.

III.B Operators shall be certified as Very Small Water System, Class I, Class II, Class III, or Class IV, with Class IV being the highest or most advanced, corresponding to each of the utility classifications referred to in *Standard II. Classification of Environmental Control Utilities*. (Note: Very Small Water System would not apply to a wastewater treatment plant).

III.C The certification board or its designee shall evaluate each applicant's qualification for certification.

III.D The applicant's qualifications for certification shall be based on satisfying minimum education and experience requirements and passing the appropriate certification examination. The education, experience, and examination requirements are corequisites. An applicant may sit for an examination before he/she satisfies the education and/or experience requirements if he/she is fully certified at the next lower certification class (except applicants for Class I are not required to have existing certification). This individual shall be issued an In-Training certificate provided he/she

has passed the appropriate exam. In-Training certificates do not qualify an applicant as fully certified. In-Training certificates shall be upgraded to full certificates upon satisfactory fulfillment of all certification requirements during the effective period of the certificate. The education and experience requirements are listed in Appendix 7.

III.E Evaluation of experience may be based on reports of environmental control agency(ies) or other agencies having appropriate responsibilities for supervising environmental control utilities.

III.F The certification board or its designee shall prepare examinations to be used in determining skill, knowledge, ability, and judgment of the applicants. The exams shall be validated. Examinations shall be taken in order from Class I to IV. Examinees are not allowed to utilize their own reference sources, such as books, notes, and programmable calculators, during the examination.

III.G The certification board or its designee shall publish upcoming exam dates, times, and locations and deadlines for application submittal; review applications and notify applicants of the status of their application; administer exams; score and report results to examinees; and review exam results and make changes in the questions and the exams as necessary.

III.H On satisfactory fulfillment of the certification requirements, the applicant shall be issued a suitable certificate designating his/her competency.

III.I "Grandparent" certificates of proper classification may be issued without examination to the person or persons verified by the governing body or owner to have been in responsible charge of the environmental control utility on or before a specified date stated in the original authorization of the certification program. A certificate so issued shall be valid only in that environmental control utility.

III.J Certificates in an appropriate classification may be issued to holders of valid certificates of competency attained by examination under the previous certification program as specified in the authorization of the new certification program.

III.K The certificate shall state the certified operator’s name, the certification class, the date of renewal, and the official certificate number.

III.L A certified operator who desires to become certified in a higher class or a different category must satisfactorily complete the requirements of the higher class or different category before a new certificate shall be issued, except those individuals seeking an In-Training certificate.

III.M Certificates shall be issued for a two-year period.

III.N Certificates shall be valid only so long as the holder uses reasonable care, judgment, and application of his/her knowledge in the performance of his/her duties.

III.O No certificate shall be valid if obtained or renewed through fraud, deceit, or the submission of inaccurate qualification data.

III.P The certificate of a certified operator shall remain valid until the certificate expires. After this period, the certificate shall automatically be invalidated unless the operator meets the renewal requirements as stated in Standard IV. Certified operators whose certificates are invalidated may be issued a new certificate of like classification provided appropriate proof of competency is presented to the certification program. Successful completion of an examination may be required at the discretion of the certification program.

Standard IV. Renewal of Certification

IV.A In-Training certificates shall not be renewed. Very Small Water System and Class I—IV certificates shall be renewed at least every two years.

IV.B To renew a Very Small Water System Operator certificate, the certified operator shall have completed at least twelve contact hours of professional growth approved by the certification board during the previous two-year period.

IV.C To renew a Class I—IV certificate, the certified operator shall have completed at least twenty-four contact hours of professional growth approved by the certification board during the previous two-year period.

IV.D Failure of a certified operator to meet these requirements or to furnish the required information shall constitute grounds for refusal to renew.

Standard V. Reciprocity

V.A Certificates issued by any other certification program which satisfy the provisions of the certification program shall be accorded reciprocal treatment and shall be recognized as valid and sufficient within the purview of the certification program.

Standard VI. Staffing

VI.A The certification program shall be furnished with adequate staff to administer the program under the direction of the certification board. Duties which apply only to the certification program include those related to processing applications, administering exams, and issuing and renewing certificates.

VI.B For certification duties alone, there should be at least one staff member per 1,000 active certificates. This can be supplied by one or more persons working part time. Staff requirements will vary widely depending on program requirements such as whether the program is changing; whether data processing is used; the amount of time devoted to the program by certification board members; and the method of preparing, administering and scoring exams. For programs with 500 or more certificates, it is more efficient to utilize data processing to maintain records of active certified operators,

renewals, and compliance status of utilities and the work force with certification requirements.

VI.C The certification officer is responsible for managing the certification program and should be properly qualified to handle all day-to-day business. He/she prepares material for certification board meetings; receives fees and deposits them in the proper account; sends out applications as requested and processes the completed applications; schedules and announces exam dates and locations; arranges for administration and scoring of the exams; issues the new certificates and renewals as directed; and tracks compliance of utilities and employees with the certification law and regulations.

Standard VII. Funding

VII.A Such sums as may be necessary to carry out the provisions of the certification program shall be appropriated.

VII.B The certification program should establish the fees at the level necessary for the certification program to be self-supporting, at least to the extent of direct costs. Fees may be charged for application, exam, re-examination, and renewal.

VII.C All fees received for certification shall be kept in a designated fund available for use by the certification program only.

Standard VIII. Enforcement and Compliance

VIII.A The certification program shall have the authority to impose penalties against the owner of an environmental control utility and/or an individual who illegally performs the duties of a certified operator.

VIII.B The certification program shall maintain an up-to-date accurate roster of all utilities requiring certified operators, of the specific positions in each utility requiring certified operators, and of the certification status of the employees who fill the positions requiring a certified operator. The certification program should utilize this information for enforcement.

VIII.C The certification program shall determine the compliance of all environmental utilities and operators covered by the certification program with the requirements of the certification legislation and/or regulations, and act on this information where there are violations. The certification board must be prepared to face the problem of a certified operator who does not measure up to the standards of skill, knowledge, ability, responsibility, integrity, and judgment required for such a position.

VIII.D The certification board shall not fail to exercise its responsibility to revoke the certificate of an unqualified certified operator. The certification program may revoke a certificate, following a hearing before the certification board, when it is found that the

certified operator has practiced fraud or deception; that reasonable care, judgment or the application of his/her knowledge or ability was not used in the performance of his/her duties; or that the certified operator is incompetent or unable to perform his/her duties properly. Appeal from the decision of the certification program may be made to a court of competent jurisdiction. Certifying authorities having renewal requirements may be able to use less extreme measures by discouraging a renewal application or refusing to grant a renewal.

Standard IX. Program Evaluation

IX.A The certification board shall evaluate its effectiveness and efficiency at least annually, and make the necessary changes.

Appendix 1. Points Classification System

Environmental control treatment plants (not including very small water systems as defined in Appendix 2) shall be classified according to the following point system, using the Plant Point Rating Systems in Appendices 3 - 5:

Class I	30 points or less
Class II	31 to 55 points
Class III	56 to 75 points
Class IV	76 points or greater

These rating systems are intended as models for certification authorities. They are intended as guidance both to new programs and to existing programs that are updating their regulations or procedures.

Note: For all point rating systems, each unit process should have points assigned only once. For multiple identical process units, do not double count. For example, a water treatment plant that has two flocculators should be given two points, NOT four points. However, for a plant having more than one type of unit for each process, points accrue for each unique unit type.

Appendix 2. Very Small Water System

Very Small Water System means a community public water system* that serves 500 persons or less or a noncommunity public water system** and has no treatment other than disinfection or has only treatment which does not require any chemical treatment, process adjustment, backwashing or media regeneration by an operator (e.g. calcium carbonate filters, granular activated carbon filters, cartridge filters, ion exchangers).

Definitions from the Safe Drinking Water Act:

Public Water System - The term "public water system" means a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least fifteen service connections or regularly serves at least twenty-five individuals.

* Community Water System - The term "community water system" means a public water system that
A. serves at least 15 service connections used by year-round residents of the area served by the system; or
B. regularly serves at least 25 year-round residents.

** Noncommunity Water System - The term "noncommunity water system" means a public water system that is not a community water system.

Appendix 3. Water Treatment Plant Point Rating System

A water system with a groundwater supply and only (non-gaseous) chlorination is considered a distribution system, not a water treatment facility. A water system with the addition of any chemical to a public water supply other than for chlorination shall be considered a treatment facility and should use this rating worksheet to determine the classification of the facility, using the Points Classification System in Appendix 1. Each unit process should have points assigned only once.

Item	Points Possible
Size	
Design flow average day, or peak month's average day, whichever is larger (1 point per 0.5 MGD. Round up.) Design flow: Consider this to be the design capacity of the plant. Examples: 9.2 MGD = 19 points 4.7 MGD = 10 points (20 points maximum allowed)	1 - 20
Water Supply Sources (Rating based on public health significance)	
Seawater/saltwater	0
Groundwater	0
Groundwater under direct influence of surface water (GWI)	8
Surface water	10
Average Raw Water Quality Variation - Applies to all sources (surface and groundwater). Key is the effect on treatment process changes that would be necessary to achieve optimized performance. • Little or no variation - no treatment provided except disinfection (0 points) • Minor variation - e.g. "high quality" surface source appropriate for slow sand filtration (1 point) • Moderate variation in chemical feed, dosage changes made: monthly (2 points), weekly (3 points), or daily (4 points) • Variation significant enough to require pronounced and/or very frequent changes (5 points) • Severe variation - source subject to non-point discharges, agricultural/urban storm runoff, flooding (7 points) • Raw water quality subject to agricultural or municipal waste point source discharges (8 points) • Raw water quality subject to industrial waste pollution (10 points)	0 - 10
Raw water quality is subject to:	
• Taste and/or odor for which treatment process adjustments are routinely made [1]	2
• Color > 15 CU (not due to precipitated metals) - ***see exceptions in Note 1 at end of table*** [1]	3
• Iron or/and manganese > MCL: Fe (2 points), Mn (3 points) (3 points maximum allowed) - ***see exceptions in Note 1 at end of table*** [1]	2 - 3
• Algal growths for which treatment process adjustments are routinely made [1]	3

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Chemical Treatment/Addition Processes	
Fluoridation	4

Disinfection/Oxidation (Note: Points are additive to a maximum of 15 points allowed for this category.)
CHECK ☑ ALL THAT APPLY:
• Chlorination:
  • Hypochlorites (5 points) ☐
  • If generated on site (add 1 point) ☐
  • Chlorine gas (8 points) ☐
  • Chloramination (10 points) ☐
  • Chlorine dioxide (10 points) ☐
• Ozonation (10 points) ☐
• UV Irradiation (2 points) ☐
• Iodine, Peroxide, or similar (5 points) ☐
• Potassium permanganate (4 points) ☐ (If used with greensand filtration do not give 4 points)
	0 - 15

pH adjustment for process control (e.g. pH adjustment aids coagulation)	4
Stability or Corrosion Control (If the same chemical is used for both Corrosion Control and pH adjustment, count points only once)	4
Coagulation/Flocculation & Filter Aid	
Primary coagulant addition	6
Coagulant aid / Flocculant chemical addition (in addition to primary coagulant use)	2
Flocculation	2
Filter aid addition (Non-ionic/anionic polymers)	2
Clarification/Sedimentation	
Sedimentation (plain, tube, plate)	4
Contact adsorption	6
Other clarification processes (air flotation, ballasted clarification, etc.)	6
Upflow clarification ("sludge blanket clarifier") [2]	8
Filtration	
Granular media filtration (Surface water/GWI) ≤ 3 gpm/sq ft	10
Granular media filtration (Surface water/GWI) > 3 gpm/sq ft	20
Groundwater filtration	6
Membrane filtration • For compliance with a primary regulation (10 points) • For compliance with a secondary regulation (6 points)	6-10
Diatomaceous earth (pre-coat filtration)	10
Cartridge/bag	5
Pre-filtration (staged cartridges, pressure sand w/o coagulation, etc.): add one point per stage to maximum of 3 points	1 - 3
Slow sand	5
Other Treatment Processes	
Aeration	3
Air stripping (including diffused air, packed tower aeration)	5
Ion-exchange/softening	5
Greensand filtration	10
Lime-soda ash softening (includes: chemical addition, mixing/flocculation/ clarification/filtration - do not add points for these processes separately)	20

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Granular activated carbon filter (do not assign points when included as a bed layer in another filter)	5
Powdered activated carbon	2
Blending sources with significantly different water quality • To achieve MCL compliance (4 points) • For aesthetic reasons (2 points)	2-4
Reservoir management employing chemical addition	2
Electrodialysis	15
Other: Certification authority may assign 2 to 15 additional points for processes not listed elsewhere in this document. (Specify: _____)	2 - 15
Residuals Disposal	
• Discharge to surface, sewer, or equivalent (0 points) • On-site disposal, land application (1 point) • Discharge to lagoon/drying bed, with no recovery/recycling – e.g. downstream outfall (1 point) • Backwash recovery/recycling: discharge to basin or lagoon and then to source (2 points) • Backwash recovery/recycling: discharge to basin or lagoon and then to plant intake (3 points)	0 - 3
Facility Characteristics	
Instrumentation - Use of SCADA or similar instrumentation systems to provide data, with: • Monitoring/alarm only, no process operation - plant has no automated shutdown capability (0 points) • Limited process operation - e.g. remote shutdown capability (1 point) • Moderate process operation - alarms and shutdown, plus <u>partial</u> remote operation of plant (2 points) • Extensive or total process operation - alarms and shutdown, full remote operation of plant possible (4 points)	0 - 4

<u>Notes</u>:

[1] **Raw water quality is subject to**:
- Taste and/or odor for which treatment process adjustments are routinely made (2 points): 1) T&O issue has been identified in a pre-design report, etc., 2) a process has been installed to address, and 3) operational control adjustments are made at least seasonally. Do not give points for T&O when there is no specific additional impact on operation. E.g. if a system is already pre-chlorinating for disinfection, give no points for T&O.
- Color > 15 CU (not due to precipitated metals) (3 points) ***with following exceptions***. Color will be considered elevated and points assigned when levels exceed 75 Color Units (CU) for conventional filtration, 40 CU for direct filtration, or 15 CU for all other technologies, <u>except</u> reverse osmosis (no points given for color for reverse osmosis).
- Iron and/or manganese > MCL: Fe (2 points), Mn (3 points) (3 points maximum allowed) ***with following exceptions***. Iron and manganese levels will be considered elevated and points assigned if they are greater than the MCL, <u>except</u> for applications of manganese greensand filters. For applications of manganese greensand filters, iron and manganese levels will be considered elevated when their combined level exceeds 1.0 mg/L (3 points allowed).
- Algal growths for which treatment process adjustments are routinely made (3 points): Raw water will be considered subject to algae growths when treatment processes are <u>specifically</u> adjusted due to the presence of high levels of algae on at least a weekly basis for at least two months each year.

[2] **Upflow clarification** ("sludge blanket clarifier") – 8 points – Also known as sludge blanket clarification. Includes such proprietary units as Super-Pulsator. These units include processes for flocculation and sedimentation. Important note: these are <u>not</u> the same as adsorption clarifiers.

Water Treatment Definitions

Definitions reprinted from "Master Glossary of Water and Wastewater Terms," [http://www.owp.csus.edu/glossary/glossary.php], with permission from Office of Water Programs, California State University, Sacramento.

Adsorption
The gathering of a gas, liquid, or dissolved substance on the surface or interface zone of another material.

Aeration
The process of adding air to water. Air can be added to water by passing air through water or passing water through air.

Air stripping
A treatment process used to remove dissolved gases and volatile substances from water. Large volumes of air are bubbled through the water being treated to remove (strip out) the dissolved gases and volatile substances.

Chloramination
The application of chlorine and ammonia to water to form chloramines for the purpose of disinfection.

Diatomaceous earth
A fine, siliceous (made of silica) "earth" composed mainly of the skeletal remains of diatoms.

Direct filtration
A method of treating water which consists of the addition of coagulant chemicals, flash mixing, coagulation, minimal flocculation, and filtration. The flocculation facilities may be omitted, but the physical-chemical reactions will occur to some extent. The sedimentation process is omitted.

Electrodialysis
The selective separation of dissolved solids on the basis of electrical charge, by diffusion through a semipermeable membrane across which an electrical potential is imposed.

Reverse osmosis
The application of pressure to a concentrated solution which causes the passage of a liquid from the concentrated solution to a weaker solution across a semipermeable membrane. The membrane allows the passage of the water (solvent) but not the dissolved solids (solutes).

SCADA system
The Supervisory Control And Data Acquisition system is a computer-monitored alarm, response, control and data acquisition system used by drinking water facilities to monitor their operations.

Stabilization
Processes that convert organic materials to a form that resists change. Organic material is stabilized by bacteria which convert the material to gases and other relatively inert substances. Stabilized organic material generally will not give off obnoxious odors.

Appendix 4. Wastewater Treatment Plant Point Rating System (Non-Industrial/Municipal)

A wastewater system with only collection, lift stations, and chlorination is considered a collection system and not a wastewater treatment facility. A wastewater treatment facility should use this rating worksheet to determine the classification of the facility, using the Points Classification System in Appendix 1. Each unit process should have points assigned only once.

Item	Points
Size (2 point minimum to 20 point maximum)	
Maximum population equivalent (PE) or part served, peak day (1 point minimum to 10 point maximum)	1 pt per 10,000 or part
Design flow average day or peak month's part flow average day, whichever is larger (1 point minimum to 10 point maximum)	1 pt per MGD or part
Variation in raw waste (0 point minimum to 6 point maximum)[1]	
Variations do not exceed those normally or typically expected	0
Recurring deviations or excessive variations of 100 to 200% in strength and/or flow	2
Recurring deviations or excessive variations of more than 200% in strength and/or flow	4
Raw wastes subject to toxic waste discharges	6
Impact of septage or truck-hauled waste (0 point minimum to 4 point maximum)	0—4
Preliminary treatment	
Plant pumping of main flow	3
Screening, comminution	3
Grit removal	3
Equalization	1
Primary Treatment	
Clarifiers	5
Imhoff tanks or similar	5
Secondary Treatment	
Fixed-film reactor	10
Activated sludge	15
Stabilization ponds without aeration	5
Stabilization ponds with aeration	8
Tertiary Treatment	
Polishing ponds for advanced waste treatment	2
Chemical/physical advanced waste treatment w/o secondary	15
Chemical/physical advanced waste treatment following secondary	10
Biological or chemical/biological advanced waste treatment	12
Nitrification by designed extended aeration only	2
Ion exchange for advanced waste treatment	10
Reverse osmosis, electrodialysis and other membrane filtration techniques	15
Advanced waste treatment chemical recovery, carbon regeneration	4
Media filtration	5

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Additional Treatment Processes	
Chemical additions (2 points each for a maximum of 6 points)	0—6
Dissolved air flotation (for other than sludge thickening)	8
Intermittent sand filter	2
Recirculating intermittent sand filter	3
Microscreens	5
Generation of oxygen	5
Solids Handling	
Solids stabilization	5
Gravity thickening	2
Mechanical dewatering	8
Anaerobic digestion of solids	10
Utilization of digester gas for heating or cogeneration	5
Aerobic digestion of solids	6
Evaporative sludge drying	2
Solids reduction (including incineration, wet oxidation)	12
On-site landfill for solids	2
Solids composting	10
Land application of biosolids by contractor	2
Land application of biosolids under direction of facility operator in direct responsible charge	10
Disinfection (0 point minimum to 10 point maximum)	
Chlorination or ultraviolet irradiation	5
Ozonation	10
Effluent discharge (0 point minimum to 10 point maximum)	
Mechanical post aeration	2
Direct recycle and reuse	6
Land treatment and disposal (surface or subsurface)	4
Instrumentation (0 point minimum to 6 point maximum)	
The use of SCADA or similar instrumentation systems to provide data with no process operation	0
The use of SCADA or similar instrumentation systems to provide data with limited process operation	2
The use of SCADA or similar instrumentation systems to provide data with moderate process operation	4
The use of SCADA or similar instrumentation systems to provide data with extensive or total process operation	6
Laboratory control (0 point minimum to 15 point maximum)[2]	
Bacteriological/biological (0 point minimum to 5 point maximum)	
• Lab work done outside the plant	0
• Membrane filter procedures	3
• Use of fermentation tubes or any dilution method; fecal coliform determination	5

(continued)

(continued from p. 13)

Chemical/physical (0 point minimum to 10 point maximum)	
• Lab work done outside the plant	0
• Push-button or visual methods for simple tests such as pH, settleable solids	3
• Additional procedures such as DO, COD, BOD, gas analysis, titrations, solids, volatile content	5
• More advanced determinations such as specific constituents; nutrients, total oils, phenols	7
• Highly sophisticated instrumentation such as atomic absorption, gas chromatography	10

1 The key concept is frequency and/or intensity of deviation or excessive variation from normal or typical fluctuations; such deviation can be in terms of strength, toxicity, shock loads, I/I, with points from 0 to 6.

2 The key concept is to credit laboratory analyses done on-site by plant personnel under the direction of the operator in direct responsible charge with points from 0 to 15.

Wastewater Treatment Definitions

Activated sludge
Wastewater treatment by aeration of suspended organisms followed by clarification, including extended aeration, Intermittent Cycle Extended Aeration System (ICEAS), and other similar processes. A sequencing batch reactor with the purpose of providing this form of treatment would be rated under this category.

Biological or chemical/biological advanced waste treatment
The advanced treatment of wastewater for nutrient removal including nitrification, denitrification, or phosphorous removal utilizing biological or chemical processes or a combination. If the facility is designed to nitrify based solely on detention time in an extended aeration system, only the points for nitrification by designed extended aeration should be given.

Chemical addition
The addition of a chemical to wastewater at an application point for the purposes of adjusting pH or alkalinity, improving solids removal, dechlorinating, removing odors, providing nutrients, or otherwise enhancing treatment, excluding chlorination for disinfection of effluent and the addition of enzymes or any process included in the Tertiary Chemical/Physical Processes. The capability to add a chemical at different application points for the same purpose should be rated as one application; the capability to add a chemical(s) to dual units should be rated as one application; and the capability to add a chemical at different application points for different purposes should be rated as separate applications.

Chemical/physical advanced treatment following secondary
The use of chemical or physical advanced treatment processes following (or in conjunction with) a secondary treatment process. This would include processes such as carbon adsorption, air stripping, chemical coagulation and precipitation, etc.

Chemical/physical advanced treatment without secondary
The use of chemical or physical advanced treatment processes without the use of a secondary treatment process. This would include processes such as carbon adsorption, air stripping, chemical coagulation and precipitation, etc.

Direct Responsible Charge
Direct Responsible Charge (DRC) is active day to day technical direction and supervision or active day to day accountability and/or authority for process control decisions of a facility or major segment of a facility that directly impacts public health and/or the environment.

Fixed-film reactor
Biofiltration by trickling filters or rotating biological contactors followed by secondary clarification.

Imhoff tanks (or similar)
Imhoff tanks, septic tanks, spirogester, clarigester, or other single unit for combined sedimentation and digestion.

Land application of biosolids by contractor
The land application or beneficial reuse of biosolids by a contractor outside of the control of the operator in direct responsible charge of the wastewater treatment facility.

Land treatment and disposal (surface or subsurface)
The ultimate treatment and disposal of the effluent onto the surface of the ground by rapid infiltration or rotary distributor or by spray irrigation. Subsurface treatment and disposal would be accomplished by infiltration gallery, injection, or gravity or pressurized drain field.

Mechanical dewatering
The removal of water from sludge by any of the following processes and including the addition of polymers in any of the following: vacuum filtration; frame, belt, or plate filter presses; centrifuge; or dissolved air flotation.

Mechanical post-aeration
The introduction of air into the effluent by mechanical means such as diffused or mechanical aeration. Cascade aeration would not be assigned points.

Media filtration
The advanced treatment of wastewater for removal of solids by sand or other media or mixed media filtration.

Solids composting
The biological decomposition process producing carbon dioxide, water, and heat. Typical methods are windrow, forced air-static pile, and mechanical.

Solids stabilization
The processes to oxidize or reduce the organic matter in the sludge to a more stable form. These processes reduce pathogens or reduce the volatile organic chemicals and thereby reduce the potential for odor. These processes would include lime (or similar) treatment and thermal conditioning. Other stabilization processes such as aerobic or anaerobic digestion and composting are listed individually.

Appendix 5. Industrial Waste Treatment Plant Point Rating System

An industrial waste treatment facility should use this rating worksheet to determine the classification of the facility, using the Points Classification System in Appendix 1. Each unit process should have points assigned only once.

Item	Points
Size (1 point minimum to 10 point maximum)	
Design flow average day or peak month's flow average day, whichever is larger (1 point minimum to 10 point maximum)	1 pt per MGD or part
Preliminary Treatment	
Grease removal	3
Plant pumping of main flow	3
Screening, comminution, microscreens	3
Grit removal	3
Equalization	1
Sedimentation/clarification	5
Primary Treatment	
Dissolved air flotation	3
Coagulation/flocculation	5
Secondary Treatment	
Bio-filtration with secondary clarifiers	10
Activated sludge w/ secondary clarifiers (including extended aeration, oxidation ditches)	15
Stabilization ponds without aeration	5
Stabilization ponds with aeration	8
Tertiary Treatment	
Ion exchange for advanced waste treatment	10
Reverse osmosis, electrodialysis and other membrane filtration techniques	15
Chemical recovery, carbon regeneration	4
Polishing ponds for advanced waste treatment	2
Chemical/physical advanced waste treatment w/o secondary	15
Chemical/physical advanced waste treatment following secondary	10
Biological or chemical/biological advanced waste treatment	12
Additional Treatment Processes	
pH adjustment	1
Oil separation	3
Chemical pretreatment (except chlorination, enzymes)	4
Filtration	6
Air stripping	5

(continued)

(continued from p. 16)

Solids Handling	
Solids conditioning	2
Solids thickening	5
Anaerobic digestion of solids	10
Aerobic digestion of solids	6
Evaporative sludge drying	2
Irrigation of solids	5
Mechanical dewatering	8
Solids reduction (including incineration, wet oxidation)	12
On-site landfill for solids	2
Solids composting	10
Disinfection (0 point minimum to 10 point maximum)	
No disinfection	0
Chlorination or comparable	5
On-site generation of disinfectant	5
Effluent Discharge (0 point minimum to 21 point maximum)	
Post aeration	4
Receiving stream sensitivity (0 point minimum to 6 point maximum)[1]	
• "Effluent limited segment" in US EPA terminology; secondary treatment is adequate	0
• More than secondary treatment is required	2
• "Water quality limited segment" in US EPA terminology; stream conditions are very critical (dry run, for example) and a very high degree of treatment is required	3
• Direct recycle and reuse	6
Land disposal—evaporation	2
Subsurface disposal	4
Biological or chemical scrubbers for odor control	5
Instrumentation (0 point minimum to 6 point maximum)	
The use of SCADA or similar instrumentation systems to provide data with no process operation	0
The use of SCADA or similar instrumentation systems to provide data with limited process operation	2
The use of SCADA or similar instrumentation systems to provide data with moderate process operation	4
The use of SCADA or similar instrumentation systems to provide data with extensive or total process operation	6

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Laboratory control (0 point minimum to 20 point maximum)[2]	
Bacteriological/biological (0 point minimum to 10 point maximum)	
• Lab work done outside the plant	0
• Membrane filter procedures	3
• Use of fermentation tubes or any dilution method; fecal coliform determination	5
• Biological identification	7
• Viral studies or similarly complex work conducted on-site	10
Chemical/physical (0 point minimum to 10 point maximum)	
• Lab work done outside the plant	0
• Push-button or visual methods for simple tests (pH, settleable solids)	3
• Additional procedures (DO, COD, BOD gas analysis, titrations, solids, volatile content)	5
• More advanced determinations (specific constituents; nutrients, total oils, phenols)	7
• Highly sophisticated instrumentation (atomic absorption, gas chromatography)	10

1 The key concept is the degree of dilution provided under low flow conditions with points from 0 to 6.

2 The key concept is to credit laboratory analyses done on-site by plant personnel under the direction of the operator in direct responsible charge with points from 0 to 20.

Industrial Waste Treatment Definitions

Activated sludge
Wastewater treatment by aeration of suspended organisms followed by clarification, including extended aeration, Intermittent Cycle Extended Aeration System (ICEAS), and other similar processes. A sequencing batch reactor with the purpose of providing this form of treatment would be rated under this category.

Biological or chemical/biological advanced waste treatment
The advanced treatment of wastewater for nutrient removal including nitrification, denitrification, or phosphorous removal utilizing biological or chemical processes or a combination. If the facility is designed to nitrify based solely on detention time in an extended aeration system, only the points for nitrification by designed extended aeration should be given.

Chemical pretreatment
The addition of a chemical to wastewater at an application point for the purposes of adjusting pH or alkalinity, improving solids removal, dechlorinating, removing odors, providing nutrients, or otherwise enhancing treatment, excluding chlorination for disinfection of effluent and the addition of enzymes or any process included in the Tertiary Chemical/Physical Processes. The capability to add a chemical at different application points for the same purpose should be rated as one application; the capability to add a chemical(s) to dual units should be rated as one application; and the capability to add a chemical at different application points for different purposes should be rated as separate applications.

Chemical/physical advanced treatment following secondary
The use of chemical or physical advanced treatment processes following (or in conjunction with) a secondary treatment process. This would include processes such as carbon adsorption, air stripping, chemical coagulation and precipitation, etc.

Chemical/physical advanced treatment without secondary
The use of chemical or physical advanced treatment processes without the use of a secondary treatment process. This would include processes such as carbon adsorption, air stripping, chemical coagulation and precipitation, etc.

Direct Responsible Charge
Direct Responsible Charge (DRC) is active day to day technical direction and supervision or active day to day accountability and/or authority for process control decisions of a facility or major segment of a facility that directly impacts public health and/or the environment.

Filtration
The advanced treatment of wastewater for removal of solids by sand or other media or mixed media filtration.

Land treatment and disposal (surface or subsurface)
The ultimate treatment and disposal of the effluent onto the surface of the ground by rapid infiltration or rotary distributor or by spray irrigation. Subsurface treatment and disposal would be accomplished by infiltration gallery, injection, gravity, or pressurized drain field.

Mechanical dewatering
The removal of water from sludge by any of the following processes and including the addition of polymers in any of the following: vacuum filtration; frame, belt, or plate filter presses; centrifuge; or dissolved air flotation.

Appendix 6. Distribution and Collection System Point Ratings

Distribution System Point Rating System

Distribution systems shall be rated according to the population served as follows:

1,500 and less	Class I
1,501 to 15,000	Class II
15,001 to 50,000	Class III
50,001 and greater	Class IV

"In-line" treatment (such as booster pumping, chlorination, or stabilization) is considered an integral part of the distribution system.

Collection System Point Rating System

Collection systems shall be rated according to the population served as follows:

1,500 and less	Class I
1,501 to 15,000	Class II
15,001 to 50,000	Class III
50,001 and greater	Class IV

"In-line" treatment (such as lift stations, chlorination, or odor control) is considered an integral part of the collection system.

Appendix 7. Operator Education and Experience Requirements

The education and experience requirements for operators are:

Very Small Water System

- Six contact hours of very small water system education; and
- Six months of acceptable operating experience of a very small water system or higher utility.
- No substitution for experience shall be permitted.
- No substitution for education shall be permitted.

Class I

- High school diploma, GED, or equivalent; and
- One year of acceptable operating experience of a Class I or higher utility.
- No substitution for experience shall be permitted.

Class II

- High school diploma, GED, or equivalent; and
- Three years of acceptable operating experience of a Class I or higher utility.
- A maximum of 675 contact hours, or sixty-eight CEUs, or sixty-eight quarter credits, or forty-five semester credits of post high school education in the environmental control field, engineering or related science may be substituted for one and one-half years of operating experience.

Class III

- High school diploma, GED, or equivalent; and
- 900 contact hours, or ninety CEUs, or ninety quarter credits, or sixty semester credits of post high school education in the environmental control field, engineering or related science; and
- Four years of acceptable operating experience of a Class II or higher utility, including two years of direct responsible charge. Direct Responsible Charge (DRC) is active day to day technical direction and supervision or active day to day accountability and/or authority for process control decisions of a facility or major segment of a facility that directly impacts public health and/or the environment.
- A maximum of 900 contact hours, or ninety CEUs, or ninety quarter credits, or sixty semester credits of appropriate post high school education in the environmental control field, engineering or related science may be substituted for two years of experience; however, the applicant must still have one year of direct responsible charge experience.
- A maximum of one year of direct responsible charge experience in a Class II or higher position may be substituted for 450 contact hours, or forty-five CEUs, or forty-five quarter credits, or thirty semester credits of post high school education in the environmental control field, engineering or related science.

Class IV

- High school diploma, GED, or equivalent; and
- 1,800 contact hours, or 180 CEUs, or 180 quarter credits, or 120 semester credits of post high school education in the environmental control field, engineering or related science; and
- Four years of acceptable operating experience of a Class III or higher utility, including two years of direct responsible charge. Direct Responsible Charge (DRC) is active day to day

technical direction and supervision or active day to day accountability and/or authority for process control decisions of a facility or major segment of a facility that directly impacts public health and/or the environment.

- A maximum of 900 contact hours, or ninety CEUs, or ninety quarter credits, or sixty semester credits of appropriate post high school education in the environmental control field, engineering or related science may be substituted for two years of experience; however, the applicant must still have one year of direct responsible charge experience.
- A maximum of two years of direct responsible charge experience in a Class III or higher position may be substituted for 900 contact hours, or ninety CEUs, or ninety quarter credits, or sixty semester credits of post high school education in the environmental control field, engineering or related science.

Substitutions

- Education applied to the operating and direct responsible charge experience requirement shall not also be applied to the education requirement.
- Operating or direct responsible charge experience applied to the education requirement shall not also be applied to the operating or direct responsible charge experience requirement.
- One year of operating or direct responsible charge experience may be substituted for one year of high school, without limit.
- Where applicable, related experience in maintenance, laboratories, other environmental control utility positions and allied trades such as plumbing, or other certification categories, may be substituted for one-half of the operating or direct responsible charge experience requirement; however, the applicant for Class III and IV must still have one year of direct responsible charge experience.
- The maximum substitution of education and related experience for operating or direct responsible charge experience shall not exceed fifty percent of the stated operating or direct responsible charge experience requirement.